

AMENDMENTS TO THE CLAIMS:

Please amend the claims as follows:

1. (Currently Amended) An electric charge transfer apparatus, comprising:

a plurality of columns of photoelectric conversion elements, each column of photoelectric conversion elements containing a plurality of photoelectric conversion elements,

a plurality of columns of vertical charge transfer devices, each column of the plurality of columns of vertical charge transfer devices being which is formed adjacent to each column of the [[a]] plurality of photoelectric conversion elements and transferring transfers a signal electric charge converted by each the photoelectric conversion element of the adjacent column of photoelectric conversion elements;

a plurality of charge-discharging circuit sets each formed at an end of each column of the vertical transfer units near an horizontal charge transfer device, each charge-discharging circuit set including at least two charge-discharging circuits connected in a serial manner for discharging the signal electric charge transferred by at least one of adjacent vertical transfer devices, and each of the at least two charge-discharging circuits forming one vertical transfer device, wherein a first charge-discharging circuit of the at least two charge-discharging circuits discharges the signal electric charge transferred by at least one of adjacent vertical transfer devices at a predetermined position, and a second charge-discharging circuit of the at least two charge-discharging circuits discharges the signal electric charge left by the first charge-discharging circuit to an outside of the electric charge transfer apparatus;

the horizontal charge transfer device being formed at a lower end of the columns of the vertical charge transfer devices and connected at one end thereof with an output circuit,

wherein the output circuit outputs the signal electric charge transferred by the vertical charge transfer devices to the outside of the electric charge transfer apparatus.

2. (Withdrawn) An electric charge transfer apparatus according to claim 1, wherein said vertical charge transfer devices are configured in parallel to each other; and a charge-discharging direction of at least one of the charge-discharging circuits formed next to each vertical transfer device is an opposite direction of a charge-discharging direction of other charge-discharging circuits formed next to the same vertical transfer device.

3. (Withdrawn) An electric charge transfer apparatus according to claim 1, wherein said charge-discharging circuit comprises an overflow drain shared with other charge-discharging circuit corresponding to the same vertical charge transfer device.

4. (Withdrawn) An electric charge transfer apparatus according to claim 3, wherein a number of said overflow drain is about a half of a number of columns of the said vertical transfer devices.

5. (Withdrawn) An electric charge transfer apparatus according to claim 1, wherein said charge-discharging circuit comprises a control gate that controls discharging of electric charge independently from other charge-discharging circuit corresponding to the same vertical charge transfer device.

6. (Currently Amended) A solid-state imaging device, comprising:

a semiconductor substrate;

a plurality of photoelectric conversion elements formed on said semiconductor substrate;

a plurality of vertical charge transfer devices formed above said semiconductor substrate, each of which is formed adjacent to each of the photoelectric conversion ~~elements~~ element and transfers a signal electric charge ~~photoelectric~~ converted by the adjacent photoelectric conversion element;

a plurality of charge-discharging circuit sets formed at an end of each ~~column~~ of the vertical transfer device near a horizontal charge transfer circuit, each charge-discharging circuit set including at least two charge-discharging circuits connected in a serial manner for discharging the signal electric charge converted by the photoelectric conversion element at a predetermined position and transferred by at least one of adjacent vertical transfer devices, and each of the at least two charge-discharging circuits forming one vertical transfer unit, wherein a first charge-discharging circuit of the at least two charge-discharging circuits discharges the signal electric charge transferred by at least one of adjacent vertical transfer devices at a predetermined position, and a second charge-discharging circuit of the at least two charge-discharging circuits discharges the signal electric charge left by the first charge-discharging circuit to outside of the electric charge transfer apparatus;

the horizontal charge transfer device being formed at a lower end of the vertical charge transfer devices and connected at one end thereof to an output circuit,

wherein the output circuit outputs the signal electric charge transferred by the vertical charge transfer devices to outside.

7. (Withdrawn) An electric charge transfer apparatus according to claim 6, wherein said vertical charge transfer devices are configured in parallel to each other; and a charge-discharging direction of at least one of the charge-discharging circuits formed next to each vertical transfer device is an opposite direction of a charge-discharging direction of other charge-discharging circuits formed next to the same vertical transfer device.

8. (Withdrawn) An electric charge transfer apparatus according to claim 6, wherein said charge-discharging circuit comprises an overflow drain shared with other charge-discharging circuit correspond to the same vertical charge transfer device.

9. (Withdrawn) An electric charge transfer apparatus according to claim 8, wherein a number of said overflow drain is about a half of a number of columns of the said vertical transfer devices.

10. (Withdrawn) An electric charge transfer apparatus according to claim 6, wherein said charge-discharging circuit comprises a control gate that controls discharging of electric charge independently from other charge-discharging circuit corresponding to the same vertical charge transfer device.

11. (Withdrawn) An electric charge transfer apparatus, comprising:
a plurality of vertical charge transfer devices, each of which has plural lines of charge transfer electrodes and transfers signal electric charge;

a plurality of charge-discharging circuits arranged to each line of the charge transfer electrodes, each of the charge-discharging circuit selectively discharging the signal electric charge transferred by the vertical charge device to a discharging direction different from other charge-discharging circuit; and

an output circuit that outputs the signal electric charge transferred by the vertical charge transfer devices to an outside of the electric charge transfer apparatus.

12. (Withdrawn) An electric charge transfer apparatus according to claim 11, wherein said charge-discharging circuit comprises an overflow drain shared with other charge-discharging circuit corresponding to the same vertical charge transfer device, and

a number of said overflow drain is about a half of a number of columns of the said vertical transfer devices.

13. (Withdrawn) A solid-state imaging device, comprising:

a semiconductor substrate;

a plurality of photoelectric conversion elements formed on said semiconductor substrate;

a plurality of vertical charge transfer device formed above said semiconductor substrate, which transfer signal electric charge photoelectric converted by said photoelectric conversion elements;

a plurality of charge-discharging circuits arranged to each line of the charge transfer electrodes, each of the charge-discharging circuit selectively discharging the signal electric charge converted by the photoelectric conversion element at a

predetermined position and transferred by the vertical charge transfer device to a discharging direction different from other charge-discharging circuit; and

an output circuit that outputs the signal electric charge transferred by the vertical charge transfer devices to an outside of the electric charge transfer apparatus.

14. (Withdrawn) An electric charge transfer apparatus according to claim 13, wherein said charge-discharging circuit comprises an overflow drain shared with other charge-discharging circuit corresponding to the same vertical charge transfer device, and

a number of said overflow drain is about a half of a number of columns of the said vertical transfer devices.

15. (Canceled)

16. (Currently Amended) An electric charge transfer apparatus according to claim 1, wherein the horizontal charge transfer device receives the signal electric charge in parallel from the plurality of columns of vertical charge transfer circuits and transfers the received signal electric charge in sequence to the output circuit.

17. (Currently Amended) An electric charge transfer apparatus according to claim 1, wherein ~~[[a]]~~ the first charge-discharging circuit of the at least two charge-discharging circuits selectively discharge the signal electric charge transferred by ~~from~~ the plurality of vertical charge transfer devices.

18. (Currently Amended) An electric charge transfer apparatus according to claim 17, wherein ~~[[a]]~~ the second charge-discharging circuits of the at least two charge-

discharging circuits discharges the signal electric charge left after the discharging of the first charge-discharging circuit.

19. (Canceled)

20. (Canceled)